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THE COAL FIELDS OF CHEROKEE COUNTY.

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The coal mines of Cherokee county are developed to such an extent that they are exceedingly interesting, both from an industrial and a scientific standpoint. The distinct veins of coal that have been found are very numerous, but the number of those which are valuable as a source of fuel is not so great. The boundary line between the Carboniferous and the Sub-carboniferous has been quite poorly defined.

On the accompanying map, the blue line marks this division line with a tolerable degree of accuracy. The small red spots farther west indicate locations where the Sub-carboniferous has been reached by digging. The south one marked in section 7, township 34, south, range 25, east, is on a hill some fifty feet higher than the surrounding plain. Near the south side of the hill, a well was sunk over sixty feet deep without striking the Sub-carboniferous, while on the northern slope, some two hundred yards away, it was reached within twenty feet. The other mark in this section shows where a well reached it in twenty feet.

In the north-central portion of section 12, township 34, south, range 24, east, is an outcropping of Sub-carboniferous rocks. The surface here is but little if any lower than at any point between here and Spring river; yet at one and a half miles east, at a depth of fifteen feet, a four-inch vein of coal was found. These facts indicate that at some time there has been a slight disturbance of the formation, either before or after the deposition of the Carboniferous, or that the Sub-carboniferous was left uneven by erosion.

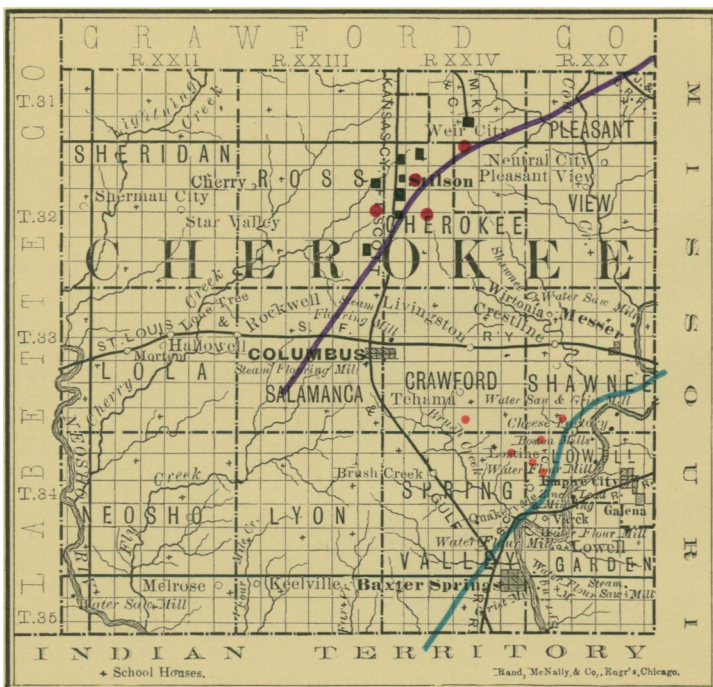
I am inclined to think that the only way this Sub-carboniferous can ever be successfully studied, is to consider it in its relations to the Ozark and Boston mountains. It is generally admitted that there is a mountainous ridge of archæan rocks extending in a southwesterly direction from the vicinity of Iron Mountain, in Missouri, to the western line of Arkansas, passing through Pulaski, Salina and Hot Springs counties of that State. This archæan ridge is entirely concealed from view along the greater portion of its length, but the occasional outcroppings of archæan rocks, and the regular occurrence of succeeding formations, place its existence beyond much doubt. Using this as a starting point, it would seem reasonable that the principal oscillations of this mountain range would affect the Sub-carboniferous and even subsequent formations.

This idea may be carried still further. With but few local exceptions, the strata of our whole State dip to the northwest. We suppose these strata were mostly formed beneath the sea, and assumed approximately a horizontal position. If we now consider any one stratum, we find that, no matter how many times it has been emerged and submerged, its final position is one in which its eastern portion has been raised more than its western. In other words, if we represent the upward movements of a stratum by the positive sign +, and the downward movements by the negative sign —, we find that the algebraic sum of the oscillations of its eastern portion is greater than that of its western. We are thus led to look for the origin of these movements in the direction of their greatest effect—that is, towards the Ozark mountains.

When we consider the great number of alternate emergings and submergings of our State in connection with its almost uniformly unbroken strata, and the probable total absence of all eruptive rocks, this question becomes one of extreme importance to the structural geologist.

As we proceed westward from the boundary line between the two formations, we come at once into the coal region. Near the west line of section 8, township 34, south, range 25, east, a four-inch vein was found within fifteen feet of the surface. In section 13, township 34, south, range 24, east, a six-inch vein has been worked where it outcrops in a ravine. From this point westward and northward there are quite a number of places where surface veins have been worked. Still farther to the northwest is a large, almost circular, mound, which is at least 150 feet higher than the surrounding valley. It is principally located in sections 34 and 35 of township 33, south, range 24, east. It is locally called "Bald Mound." Its summit is covered with sandstone, beneath which is a ten to twelve-inch vein of coal. This vein is not more than fifteen feet below the highest point on the mound, so that its elevation is at least 130 feet above the surrounding plain. On the north side of the mound, at an altitude of fifty-five feet from the northern base, a shaft has been sunk 106 feet. It passed through three veins of coal. The first is a ten-inch vein, about nine feet below the surface; the second, a twelve-inch vein, eighteen feet deep; and the third, a five-inch vein, eighty feet below the surface. This shaft proved that the great body of the mound is a compact, black shale. The last four feet penetrated the Sub-carboniferous. As soon as the shale was reached a true "fault" was revealed. It trends southeast and northwest, and the walls on either side are inclined to the southwest, about  $12^{\circ}$  from vertical. This prevents the shaft from following the up-and-down line of the fault very far, but the first vein of coal shows it perfectly. The southwest side has been dropped fully three feet.

To the north and east of this mound is an almost unbroken hill of about an equal height with the mound. This long, circular hill is covered with sandstone underlaid with coal, which probably corresponds to that exposed on the summit of Bald Mound. The circular valley lying between the hill and mound was doubtless at one time covered by this same sandstone, coal



- S. E. Limit of Coal Measures.
- S. E. Outcropping of Wier City Vein.
- Subcarboniferous reached by digging.
- Coal mined by stripping.
- Coal mined by tunneling.

and shale. It is one of the grandest illustrations of erosion we have in the county. At a number of different places on this hill coal is being mined.

In sections 30 and 19, township 33, south, range 25, east, there is the greatest indication of disturbance I have noticed. In section 30, a ravine separates two places where coal has been mined. On the south side of the ravine the formations dip to the north, at an angle of from ten to twelve degrees. Immediately north of the ravine they dip to the south, at an angle of fully thirty degrees. The dip is greater than the incline of the hill; so much so that a few rods back from the ravine the coal outcrops on the hillside, while in the ravine it is fully six feet below the surface. Still farther north in section 19, where the hill is considerably higher, the coal is again found with a dip of about ten degrees to the south. Half a mile to the northwest are two more openings. At one of these the inclination is very plainly shown to be about ten degrees to the south. The other one is worked in an east-and-west direction, so that the dip cannot well be determined.

North of the hill is the long and almost level valley of Shawnee creek. In this valley there are at least two veins of coal, and probably three. At a good many places an eight-inch vein is worked by stripping. A deeper vein has been reached by almost every well in the valley. This vein is from twenty to thirty feet below the surface.

In section 11, township 33, south, range 24, east, a shaft has been sunk sixty feet deep. The first coal found was a twelve-inch vein at thirty feet. This seems to show an absence of the surface vein. At forty-five feet another twelve-inch vein was found, and the workmen believe that at the bottom of the shaft there is a "horse-back," which indicates a three-foot vein. From what is known of these "horse-backs," this last supposition is by no means established.

On the west side of Brush creek are numerous surface veins. Not having carefully examined them, a detailed description of them cannot be given, but they probably closely resemble those already mentioned.

The hills on the north side of Shawnee creek valley are less abrupt than those on the south. I do not know that coal has ever been found in them, but it would be no surprise to find thin veins corresponding to those farther south. On the east side of Spring river, near Smithfield, is another place where a surface vein is worked.

The next vein noted in the order of deposition is the Weir City and Stilson vein. This is the vein from which comes all the coal known in the market as "Cherokee" coal. It is extensively worked at Weir City and in the vicinity of Stilson. These two places in actual distance are but three and three-fourth miles apart, although by the roads, which follow the section lines, they are nearly six. Near each of these places the vein is shallow enough to be worked by stripping. On the accompanying map the light violet represents such places. The black squares represent shafts in which coal is mined by tunneling. At Weir City there are three such shafts. There

is no town or city at Stilson. Each coal company has built houses to rent to its miners, so that from a distance there is quite an appearance of four different villages. A careful study of this vein shows two important facts: First, That although varying in different places, its general dip is to the northwest, and is but a few feet to the mile. Second, That since the coal has been formed and compressed to its present solidity, there has been sufficient disturbance to form a great many breaks or fissures in the coal itself.

1. At the shaft north of Stilson, in section 5, a drift has been carried 225 yards to the north. In this distance the vein dipped thirteen feet. But this is very unusual. At almost all other shafts the floor is so nearly level that in a drift of 200 yards there is not enough rise or fall to be detected without careful measurements. The depth of the coal is from 28 to 40 feet. The various places marked where the mines have been worked by stripping are all on low ground, in ravines, or near to them. Just how far southeast this vein extends is not known, but it does not extend to Columbus, as is shown by a drilled well, which has been sunk 150 feet without striking it. This 150 feet consists of sandstone, shale and fire clay, and it is rumored that two or three thin veins of coal have also been passed through, although this is denied by the parties in charge of the enterprise.

Northeast of these mines the same vein is worked at Opolis and Pittsburg. These localities were not visited by the writer, but it is understood that the depths of the shafts there are in general the same as the depths of the Cherokee county shafts. In any of these places a variation of surface level would cause a corresponding variation of the depth of the coal.

With these data as guides, an attempt has been made to locate the southeastern limit of this very important vein of coal. The deep-violet line on the accompanying map is intended to represent this limit. It is interesting to note that this line is almost parallel with the line marking the boundary between the Coal-measures and the Sub-carboniferous with the line connecting the principal lead and zinc mining towns, from which it is distant about fifteen miles, and finally with the general trend of the Ozark mountains themselves.

A few miles northwest of Stilson, a 12 to 14-inch surface vein is worked. It is not known whether this is a continuous vein, or whether it is only local. This question is of no small importance; because only a few miles northwest, and therefore only a few feet higher geologically, there is an extensive limestone formation. This is the first limestone after the Sub-carboniferous, and between those two lie all of the above-mentioned coal veins. One and a half miles east of Sherman City, a boring of 200 feet found no coal. Fifteen miles east of Thayer, a vein, supposed to be the Weir City vein, was reached at 400 feet. For these statements I am indebted to Mr. R. E. Jenness, of Stilson.

Thayer has an elevation of 1,054 feet above sea level, and the point 15 miles east is about the same height. Stilson is 914 feet above sea level.

This gives 230 feet for the difference in elevation of the coal, if we reckon from the Weir City vein, and fully 300 feet, if we reckon from the surface vein referred to. The distance between the two points is 25 miles. This gives a dip of 9 feet to the mile for the Weir City vein, and of 12 feet to the mile should the coal found prove to be the surface vein above mentioned. But there can be no figures obtained which can be looked upon as being even approximately correct, until we can obtain an accurate topographical survey of the southeastern portion of the State.

2. My investigations have led me to believe that "faults" should be looked for in this part of the State. In all of these mines are a great many "horse-backs," or almost vertical seams of fire clay passing through the coal. A number of these were carefully examined, and without exception they were found to be true breaks in the coal, the irregularities of one side corresponding almost exactly with those of the other. In some instances the openings or fissures were seen to penetrate the shale above for as much as eight feet, and had the clay which filled them been removed, they would doubtless have been seen to extend much farther.

That these were made after the coal was perfectly solidified, is shown by the angles on the roughly-broken edges of the coal itself. In some cases, fragments of coal are imbedded in the fire-clay filling, and these also look to be fragments broken from perfectly solidified coal. It is difficult to ascertain the width of the fissures, because the tunnels seldom strike them at right-angles. Some are not more than twenty inches thick, while others are eight or ten feet. Their directions vary; even the same fissure does not follow the same course, but in general they trend northeast and southwest. Is it possible that they could have been formed by the northwestern portion of the strata being lowered or raised, while the southeastern remained stationary?

The sandstone and shales are very poor in fossils. I was fortunate enough to secure a very perfect specimen of the ammonite family. This was found in the shale immediately over the Weir City vein. It is of great interest, because, being a marine fossil, it shows that just after the deposition of the coal the surface was for a time covered by salt water. That this time was very short, is proved by the absence of a limestone formation.